

MONTHLY NOTICES

OF THE

ROYAL ASTRONOMICAL SOCIETY.

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November 13, 1874.

No. 1.

Professor J. C. ADAMS, President, in the Chair.

Thomas Hayward Budd, Esq., 10 Chilworth Street, Westbourne Terrace, W.;

S. W. Burnham, Esq., 52 Vincennes Avenue, Chicago, U.S.;

John Burns, Esq., Castle Wemyss, near Greenock;

Latimer Clark, Esq., 5 Westminster Chambers, S.W.;

Edmund Giles Loder, B.A., 42 Grosvenor Square, W.;

Prof. Charles Niven, M.A., Queen's College, Cork;

James Smith, Esq., 407 Liverpool Road, N.;

Dr. François Terby, Louvain, Belgium; and

Rev. Alexander Law Watherston, M.A., Warley Road, Brentwood, Essex;

were balloted for and duly elected Fellows of the Society.

Dr. Axel Möller, Director of the Observatory of Lund,

was also balloted for and duly elected an Associate of the Society.

*Preparations for the Observation of the Transit of Venus, 1874,
December 8-9.*

At the Meeting of the Society on November 13 the Astronomer Royal gave an oral account of the present state of the arrangements for the observation of the Transit of *Venus*.

The Astronomer Royal said: Gentlemen, invited by the President of the Society, I am happy to state what I am able concerning the progress of the various Expeditions. I have not thought it necessary to draw up a written paper, because at present our information is defective in various matters, and those points on which we have information do not bear in a very important degree upon the observations; but there are, nevertheless, many little details which I think will be well worthy of the attention of the Society. In the first place, I would remark

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that the observations of the planet *Venus* on the meridian, as far as we are able to see at the present time, agree well with the tables, upon which all the predictions of the transit have been founded. I think, Mr. President, this will have an especial interest for you. You may remember that, at the time the proposals for the observation of the Transit were first considered, I said that there was a doubt as to the time when the phenomena would occur. The doubt arose from the looseness of the record of Bradley's observations. It was somewhat doubtful whether he had observed the limb of the planet or its centre, and in my *Planetary Reductions* I had supposed that Bradley had observed the limb, but M. Leverrier asserted that he must have taken observations of the centre. It may be in your recollection, Mr. President, that we, as practical observers, thought it would be rather difficult to observe the centre in such a case as that. However, M. Leverrier adhered to his interpretation of the observation of the centre, and has formed his tables therefrom; and now we find that those tables are, as far as we can tell from observations made up to not many days ago, very good, and I think we must acknowledge that we were wrong upon this matter. But this is only important as it shows that we have reason to believe that there will now be no question about the minute of time at which, at any given station, the entrance of *Venus* upon the sun's disk will begin. The next point which I have to remark on is with reference to the general plan of the British observations. The general arrangement of stations is precisely the same still as it was from the beginning: no alteration whatever has been made with regard to the districts of observation, although in some districts I have made expansions of the original plan, tending to multiply the stations of observation. Having made these general remarks, I will enter into some particulars; but first of all, I must say, that there is one which ought to take precedence of all those that are being conducted at Government expense, I refer to the observations to be taken at Mauritius by Lord Lindsay. As far as I can learn from the last despatches which have reached me, Lord Lindsay had not arrived at Mauritius at that time, but was expected within a few days. But though he personally had not yet reached the Mauritius, his influence had been there long before him; for his excellent assistant, Mr. Gill, had been at the Mauritius with 43 chronometers, and though he had not a transit instrument of his own to set up (for all the instruments were in Lord Lindsay's yacht), yet he borrowed a good altazimuth by Simms from one of the local institutions, and with it he was able to get the time to his perfect satisfaction. Those who know Mr. Gill will know that he would take observations east and west with all the care necessary. These 43 chronometers had been carried out by H.M. ship *Shearwater*, under Commander Wharton, whom I had desired and hoped long ago to have on the Transit of *Venus* staff. They had been carried at that time twice backwards and forwards to our station at

Rodrigues, and comparisons had been made at Rodrigues by Lieut. Neate, the director there; and I have no doubt we have already as good an enchainment between Mauritius and Rodrigues as chronometers can give. I will say something more as to this presently, but I thought it my duty in the first place, both on account of the private character of the expedition, and of the skill, I may say grandeur, with which the expedition has been conducted, to mention Lord Lindsay's expedition first.

In mentioning the British stations I will take them in the order in which we are accustomed to take them at the Observatory. Station A is the Egyptian station. In all the printed papers circulated I have spoken of Alexandria as the station, but after a great deal of conference with Capt. Orde Browne, of the Royal Artillery, who is designated as the head of the Egyptian expedition, and also upon conference with Mr. Fowler, the engineer, who has become well acquainted with that country, and upon the report of other persons, we decided that Alexandria is not the proper place for the fundamental astronomical station. It was therefore arranged that the fundamental astronomical station should be at Cairo, that is to say, not on the level of Cairo itself, which is on a flat, and liable to haze, but on the citadel above it, or a station higher up; and that for the photographers there would be no objection to adopt Thebes as a secondary station.

I had mentioned to Lord Derby that we should have occasion for his best assistance with the Khedive, and I subsequently wrote to him and specified the extent of the assistance we were likely to want, and I believe Lord Derby made special application to the Khedive for us; the consequence is that my party has been received everywhere with the utmost good will. On arriving at Cairo they had an interview with the Khedive himself, and since have been visited by Pashas without number. The last I heard about Capt. Orde Browne was that he was making the customary preparations to receive the Pashas. I may mention that one of the considerations which determined in some degree the selection of our station in Egypt was, that in the month of December the Nile flood has just expired, the ground is still wet, and there is great risk of fog, which must be crossed by the visual ray coming to Alexandria. In the next place, the Nile flood of this year has been a high flood, almost the greatest known. Capt. Browne has sent me a sketch he has made from the citadel of Cairo. There is seen indistinctly the great Nile travelling through the valley of Egypt, with fogs about it, overhanging that great city of Cairo; the citadel seems to be perfectly free from the fogs, but he has preferred taking a station higher than the citadel, on the ridge of land which goes by the name of Mokattam, a mountain ridge between the valley of the Nile and the valley which leads to the Red Sea. He has sent me a sketch of the view as seen from his station on the Mokattam Hills. He looks absolutely over the

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spires and domes in the citadel of Cairo, and can see distinctly
 13 pyramids in the distance, the Great Pyramid being the nearest
 of all. I suppose it is a very interesting place. The Khedive has
 sent him tents, which Capt. Browne says are the best he ever saw,
 and he is anxious that I should visit him. I regret that I am unable
 to do so. Now the arrangement of things is this : his assistant, Mr.
 Hunter, goes to Alexandria for the maintenance of the communica-
 tion with the English telegraph stations, and here comes in a series
 of troubles which required an effort. I have prepared every
 station with the means of determining its longitude indepen-
 dently ; but of course when there is a telegraph reaching from
 England to Alexandria, the temptation to use it is very great.
 I have had a good deal of experience with telegraphic longitudes,
 and I dislike them ; I would rather spend a long time for the
 determination of longitudes by independent methods, than trust
 myself to all the imperfections and disappointments arising from
 a combination of telegraphic communications. At last we brought
 it to this : that if we could make a direct communication from
 England to Alexandria, that would be worth while, and should be
 done ; but failing that, I would not go through the trouble and
 chances of error arising from one station at Lisbon, and another
 at Malta, and others elsewhere, with the chance of failing after
 all, but I would trust to independent methods by celestial obser-
 vations. Capt. Browne went through a great deal of labour many
 weeks ago, with reference to this, and at last arranged it so that
 messages could be sent direct from a small place called Porthcurno
 near the Land's End, in Cornwall, to Alexandria. The length
 of the of the cable between these two places exceeds the length
 American submarine cable, in, I think, the proportion of 5 to 4 ;
 at all events, there is a considerable excess ; he has established
 at last that with due care time-signals can be sent direct from
 Porthcurno to Alexandria. This very evening, Mr. Ellis, of the
 Observatory, goes off to Porthcurno in the hope of making the
 first series of signals, and I trust he will do so safely ; but if not,
 we know what to do. The communication between Porthcurno
 and Alexandria being established so far, Capt. Browne despatches
 his assistant, Mr. Hunter, to Alexandria, to a sort of observatory,
 which is established on the top of the Exchange there. The
 place possesses one peculiar advantage. It is accessible only by
 a loose ladder, and therefore Mr. Hunter pulls up the loose
 ladder, and nobody can then interfere with him. And besides
 that, a wire is laid into the telegraph office, and it so happens
 that they have at the telegraph office a wire on one side
 which leads to Cornwall, and a wire on the other side which
 leads to Cairo and Mokattam, and so I trust we shall get our
 Mokattam longitudes very well. Capt. Abney, of the Engi-
 neers, is to be sent to Thebes with the photographic apparatus ;
 this it appears is the best station for photographic purposes, and
 he can obtain the telegraphic observations for time from the left
 bank of the Nile, by merely carrying a chronometer or two across.

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Knowing what I do of the gentlemen of this expedition, and especially their chief, Capt. Browne, who I think is inferior to none in his general skill in observations, in his ability to manage men, and in his competency to represent with propriety the dignity of the British nation and the importance of this enterprise before the authorities with whom he will have to converse, I think there never was a better selection of persons, or a better chance of success than there is in this instance. Heaven send us good weather, of which we have great hopes, and all will go on well, I am convinced. But the labours of the Egyptian station will not end there. From Cairo there is telegraphic communication to Suez; and as soon as Mr. Hunter has accomplished his work at the time-signals from Cornwall through Alexandria to Cairo, he will leave for Suez, and will then take the task of communicating with Cairo, and from Suez we hope to get communication to Aden, and from Aden to the Mauritius and that group of stations. That finishes what I have to say with regard to station A.

Now, as to Station B in the Sandwich Islands, which I look upon as one of the most important of our stations. It is placed specially under the command of Capt. Tupman, the general manager of the affairs of the Transit of *Venus*. From the earliest time I fixed upon Honolulu as one of the most important stations, but at the same time I added that it ought to be strengthened, and I hoped that the French would have supported us on the side of the Marquesas Islands; but without waiting for them (indeed the French have not satisfied my wishes) we have fixed upon three stations separated as widely as we can in the chain of the Sandwich Islands. Honolulu is the centre; the eastern station is Owhyhee, where my friend Prof. Forbes is commanding, and I hope he will not be assassinated like Capt. Cook; the western station is Atooi. The primary station, Honolulu, is furnished with the means of determining the longitude, not only a transit instrument, but an altazimuth; and from a consideration of the position of the Moon at the present time, I hope we shall get an excellent determination of longitude. There are local steamers in that group of islands, and we hope to communicate with the other stations sufficiently well by chronometers. Altogether, I hope we have the chance of three good sets of observations of the Transit of *Venus* at those places. The last I heard from them, no long time ago, was that Capt. Tupman had landed, and had been received in state by the king of the islands, and at the desire of the king, Capt. Tupman and his principal officers had been presented to him; the king was prepared with a written answer to the representations which Capt. Tupman made. Capt. Tupman and some of his officers were lodged at that time in a house belonging to one of the king's family, a niece or an aunt, I think, at all events some near relation, and there is no doubt they were well received, and that every facility will be given them. I cannot give any astronomical

information from that station, but I can give the social and diplomatic information that they were well received there, and are likely to go on well.

The third station in our order of things is Rodrigues. Rodrigues is an island at which there is no anchorage for ships close to the land, but in which there are plenty of inhabitants to take care of the expedition in a rough way. The news from this station is that all the instruments had been landed, and I confess that has overcome a great difficulty in my mind. The instruments were landed by boats, which had to pass a coral reef which is dry at low water, and is not quite dry at high water, so that the boats, as they say, "bumped" in several places with the instruments in going over, but the officers seemed to be fully persuaded that no injury was sustained. Having got over the reef, the next thing was to get the instruments up a lofty cliff, which tried their ingenuity to the utmost. They have sent me some photographs (too small to exhibit to the meeting) showing the way in which these instruments were pulled up with guy ropes and various contrivances, and somehow or other packages of about a ton each were hauled up safely, and everything seemed to be going on well. The superintendent there, Lieut. Neate, an excellent man, was not unacquainted with the island, and felt himself quite able to overcome all the difficulties of landing, and I have no doubt it has been done very well. In the meantime, as I have mentioned, the *Shearwater*, bringing chronometers from Mauritius, has been twice in the neighbourhood of the island, but those 43 chronometers have not been put on shore over the "bumping" rock. They have been kept in the ship, but a limited number of chronometers, five I believe, have been carried backwards and forwards from the transit instrument to the chronometers in the ship, so that I have no doubt that between the two stations of Mauritius and Rodrigues, we have one of the best intermediate determinations of longitude that can be found. At Rodrigues we are provided with a very good altazimuth, and the officer with it is a man I can well trust. I may say of all my officers, I cannot help feeling that every one is doing his duty a great deal better than I could have done it myself, and better satisfaction I cannot express.

Passing on to the next district of observation, which is New Zealand, the station we selected there is Christchurch, in the neighbourhood of Port Lyttelton; the difficulty of postal communication from that civilised place is very great, and I have hitherto only received one telegraphic despatch, which came to the owners of the ship which carried the party out. They passed their whole voyage without seeing land from England to New Zealand. The observers are to observe their longitude independently, by means of the instruments provided for them; and also they are to take advantage of the line of telegraph which stretches throughout the length of the southernmost of the New Zealand Islands, to determine the difference of their longitude

with Wellington, and with a certain Hutt Observatory, of which I cannot tell the position, but of which, however, the determination of the longitude has already reached me; and on the other hand, they are to use the same line of telegraph to communicate with the German station, which will be established on Bluff Port, at the extreme south-west point of the same island. In fact, all through it has been with me an object of the greatest interest to interconnect all the stations, British and foreign, as completely as possible.

The next and fifth district is in Kerguelen's Land. In carrying out the preparations for work at this important station, we have had some accidental troubles, which have given great anxiety to the observers, and have required a great deal of resolution on their part. The Rodrigues and part of the Kerguelen observers went out in one ship to the Cape, and here the observers were to be transhipped, one party was to go to Kerguelen's Land, and the other to Rodrigues; the Rodrigues ship was got off safely; but the Kerguelen ship did not arrive in time, she had met with an accident which had interfered with the action of her screw. Information was given to the Admiralty as early as possible, and the Admiralty without a moment's delay commissioned a ship, the *Volage*, to go out to them. There was nothing else to be done, but it so happened that the *Supply*, consort of the *Volage*, would require some repairs at the Cape, and a little accident happened to her also. She had to be hauled up on the slips. In Simon's Bay there was a great swell, and this ship, as I understand it, tumbled over, and it took a great deal of time and trouble to get her up. From these various causes, the delay in sailing from Cape Town extended over two months, and has given a great deal of anxiety to the observers there, especially to my excellent and valued friend Father Perry, who commands there. But the last time I heard of them, which was on the 18th of September, they were fairly off, though they ought to have left there two months earlier. One consequence of this has been, that they are a little perplexed now about the choice of stations in Kerguelen's Land. We had fixed originally on a position in Christmas Harbour, which had been favourably reported on by Capt. Cook and Sir James Ross, but the good reports were not confirmed by the visit of the *Challenger* expedition to Kerguelen's Land, so that it became expedient, as we thought, to look out for another place. These reports had got abroad to other nations; and there had arrived at the Cape of Good Hope and had sailed, an American and also a German ship, both of which expeditions were going to choose their own places in Kerguelen's Land, and my party will be obliged to take those that are left to them; but they will take good places, I have no doubt. There seemed to be also through this delay a petty storm arising. The captains of the royal ships were naturally a little impatient at the delay, and wanted to get away from Kerguelen's Land as soon as they could.

There is nothing blameable in that; they had certain naval and professional views in the matter, and I do not blame them the least in the world; but, on the other hand, I do praise the steadiness of Father Perry, who stood firm against it, and said they must stay and must prosecute the observations, whatever time they cost. This, sir, I think, finishes the information that I have to give with regard to our own stations.

With regard to other nations my information is really very defective. There had touched at the Cape, a French expedition which was to carry parties to St. Paul's Island and Campbell Island, an island south of New Zealand, and to Pekin, places widely separated, but the same French ship was to carry them all. The French have been to my mind, rather vacillating in their choice of stations. They seem to have given up two—one in the Marquesas Islands, and the other in New Caledonia, as far as I can learn; and it appears to me that the northern part of the earth in which the Transit of *Venus* can be seen will be more overloaded with observatories than it was before.

I have alluded this evening very frequently to longitudes. At Kerguelen there is nothing for it but to determine the longitude absolutely; and so at Rodrigues, unless Lord Lindsay can find a perfectly secure basis for his transit with the 43 chronometers, which I have no doubt will establish a very good communication; but at present I think they want a sufficient basis. At the Sandwich Islands they must determine the longitude absolutely; but in Egypt we hope to do it by telegraph from England, and if not we shall determine it absolutely. I may state that one of the officers at Kerguelen's Land is specially charged to try and make longitude communications with all the stations that can be brought within reach, whether German, or American, or French, or British, that is his special duty: he is a man in whom I have great confidence, and I have no doubt he will do it well. I wish to point out the necessity for this absolute determination of longitude. The probability that observations will be secured at any one place is not greater than one-half, that is the estimate which M. Struve and I have made; we discussed the question fairly, and we think that if at half the stations observations are obtained we shall be satisfied. We have for our British observations two stations in Egypt, three in the Sandwich Islands, one in Rodrigues, one in New Zealand, and two in Kerguelen's Land, making nine. At four of these there are observations of both phenomena. If from say 13 stations we can get six or seven observations, I shall be well satisfied. Now, taking the value of the probability of observations at one station as one-half, consider what this amounts to in the observations at combined stations. I will take two extreme cases: one in which there is an observation of one element only compared with another station at which the same element only (for example—the egress) can be observed; the probability that at both stations it will be observed is only $\frac{1}{4}$. But suppose I have two observations at one station in the north

and two at one station in the south, at which there is no determination of longitude, and in which the result of the observations will depend entirely upon the difference between the intervals given by the two pairs of observations, the loss of any one of these would render useless the observations at the three others (I am taking an extreme case); and if we estimate its probability, we have $\frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2}$, or the probability is only $\frac{1}{16}$ that a result from an observation of that class can be secured. It will be asked what then is to be done to render our chance of combined observations better? We must have the differences between local time and absolute time determining the longitude of those stations. If we determine the longitudes in a satisfactory manner, a comparison between the two phases at one station in the north and one station in the south will be worth double a comparison where only one phase can be observed; but all depends upon the accurate determination of longitude, and this is a point which, though it must have been present to the minds of everybody who has attended to these matters, has not been sufficiently noticed in publications on the subject. The Germans have been taking great pains to ascertain the absolute longitudes all the way as far as the Japan seas and the China seas. They have to go through a troublesome network of telegraphs, and I am glad I have nothing to do with it. This work has, I think also, been rather overlooked in publications, but it is a most important point.

I have only one small matter to add. We are, fortunately, in easy communication with Egypt; the transit will be observed there on the 9th of December, early in the morning; Captain Browne promises that we shall have a telegraphic account of it before breakfast. But as to obtaining early news from the other stations, Mr. Neumayer, a gentleman well known in the scientific world, suggested to me that it would be possible for the Australian outgoing ships to take a course nearly running along the north of Kerguelen's Land (in fact, they commonly sight it) and that they would be able to get some information of the expedition. The outgoing ships will be passing Kerguelen's Land just about the time of the transit, perhaps a day or two after, and they may be able to convey information to the southern parts of Australia, and thus a telegraphic account may reach us comparatively early, though merely as to the fact of the observation. Upon hearing this, I took the liberty of communicating with Mr. Green, of Blackwall, the owner of the splendid line of Australian ships. He received my addresses with the utmost kindness, and stated that he thought he should be able to assist me, and he instructed the captain of the ship next going out, Capt. Cooper, of the *Carlisle Castle*, to make for those places within his reach where information may be obtained. If this suggestion had only come to me two or three months earlier, we might have been able to establish communication with certainty, but now we can only act upon probabilities. I could not tell him what were the places likely to be occupied; and the ship could only undertake to run along the north-east coast of Kerguelen, and could not undertake

to go into any bay, though she would be able to send a boat ; and unless there was good reason, she could not venture to take the south-east coast. On the north-east coast there is Christmas Harbour, which, I believe, is upon the whole abandoned. The next most likely place is Port Palliser, and Capt. Cooper said that good telescopes should be used to see if there were any astronomers at that place. Then, coming towards the extremity of the island, they pass Accessible Bay, at the entrance to which is Betsy Cove. Betsy Cove has been mentioned as a good harbour, and there is an Admiralty chart of it. I mentioned that as the most likely place, and I have no doubt Capt. Cooper will send a boat in there ; but after Betsy Cove the coast turns round towards the south, and if my party should have chosen this part of the island, it seems not unlikely they will be missed ; but I thought it desirable to enter into these details, and to tell you what the chance is. I think, Sir, with this, I will close the information I have now to give.

Addendum to the Astronomer Royal's Statement on November 13.

Telegraphic connection (interrupted at Porthcurno and Alexandria) has now been made on four evenings between Greenwich and Mokattam, and I have reason to hope that the determination of longitude will prove perfectly successful. Nothing can exceed the attention to our wishes exhibited by the Eastern Telegraph Company, who, with much derangement of their own business, have given every facility for our communications.

At the last despatch, Capt. Abney had arrived at Thebes (Leuksor). Every thing is in full work.

Dr. Auwers and Mr. Döllén had arrived at Cairo, but had not definitely fixed on a station.

At Honolulu, every thing is in full work ; and Capt. Tupman specially remarks, that the Janssen apparatus succeeds perfectly. Prof. Forbes was to sail for Owhyhee on November 1.

1874, November 27.

The French Expeditions for the Observation of the Transit of Venus.

(Communicated by the Secretaries.)

We are glad to hear that communications have been received by the Academy of Sciences from the French Expeditions sent to observe the approaching transit of *Venus*. The following is translated from a notice inserted in the *Bulletin Hebdomadaire de l'Association Scientifique de France*, No. 364, 1874, October 25.

"M. Bouquet de la Grye, who has charge of the expedition to Campbell Island, arrived with it at Sydney on August 22. The commodore on the station was very obliging to our officers.